Significant Upper Triassic Microspores from Bleiberg, Austria *)

(with 3 plates)

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Abstract

Selected plant microfossils from the Cardita Shales of Upper Triassic age (Carnian) of Austria are presented. Some forms are stratigraphically important and of use in identifying the three different shale units. Seventeen species from sixteen genera are recorded of which five are new.

Introduction

This study is based on fourteen samples from the Antonio-Middle shaft of lead and zinc mines of Bleiberg (Lat. 46° 37′; Long. 31° 19′) in southern Austria. These samples belong to the Cardita Shales, (Carnian stage, Upper Triassic) the age of which is also confirmed by the presence of C a r d i t a g ü m b e l i. This is the second paper by the same author on these samples. In the first investigation, "The results of statistical analysis in Palynology from the Cardita shales (Upper Triassic) of Bleiberg, Austria" 1966 it is demonstrated, that the numerical analysis of spores and pollen assemblages is applicable in finer stratigraphical subdivision of the Upper Triassic sediments. It is also discussed that the three studied shale units (1966 fig. 1) can be readily distinguished from each other by some of the microfloras contained in them. About 54 genera and 85 species of alete, monolete, trilete spores, and pollen grains with disaccate forms of both striate and nonstriated types were enlisted.

In this paper an attempt has been made to describe only some of the important forms mentioned in the earlier paper. Seventeen species belonging to sixteen genera have been illustrated and discussed.

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*) This work has been carried out 1965 at the UNESCO Center for Geology; a revision was established during the Refresher Colloquium 1971.

This investigation reveals that the genus Raistrickia is not restricted to the Paleozoic, but can also be found in the Upper Alpine-Triassic sediments. The figured specimens are based on the single grain preparation (S. G. P.). Slides and all the types are deposited at the Palynological laboratory of the Geological Survey of Austria, Vienna.

Systematic Descriptions

Anteturma *Sporites* H. POTONIÉ, 1893

Turma *Triletes* REINSCH, 1881

Subturma *Azonotriletes* LUBER, 1935

Infraturma *Laevigati* (BENNIE & KIDSTON, 1886) POTONIÉ, 1956

Genus *Aulisporites* (LESCHIK, 1955) KLAUS, 1960

Aulisporites astigmosus (LESCHIK) KLAUS, 1960
(Pl. 1, Fig. 1)

Calamospora astigmosus LESCHIK, 1955, p. 22, pl. 2, fig. 17.
Aulisporites astigmosus (LESCHIK) KLAUS, 1960, p. 119, pl. 28, figs. 2—3; VENKATACHALA & GOÉZAN, 1964, P. 210, pl. 1, fig. 7.

Remarks: The illustrated figure with many other specimens that are fairly abundant in all examined samples, corresponds completely with the given description by KLAUS. They are dark brown in colour, subcircular in outline, and have two major folds. Trilete rays clear, but short and usually confined to a small bright circle. Exine is smooth to very finely punctate. The greatest diameter is 64 microns.

Infraturma *Apiculati* (BENNIE & KIDSTONE, 1886) POTONIÉ & KREMP, 1954

Subinfraturma *Baculati* DYBOVA & JACHOWICZ, 1957

Genus *Raistrickia* (S., W., 1944) POTONIÉ & KREMP, 1954

Generotype: *Raistrickia grovensis* SCHOPF, 1944, p. 55, text. fig. 3.

Discussion of the genus: SCHOPF, WILSON & BENTALL, 1944 in the description of the genus *Raistrickia* refer to a rounded subtriangular trilete spore ornamented with heavy truncate spines, which usually split at the terminals. In emending this genus POTONIÉ & KREMP (1954) mentioned the existence of coni between the "bacula", and expressed the opinion, that truncations are not a natural phenomenon but they are due to a latter irregular breaking of the bacula. But presence of the coni have hardly been mentioned by the other authors in the descriptions of their species. They are probably the projections of bacula from one side (distal) on to

other (proximal) side. KOSANKE (1950) in the description of *R. prisca* records the existence of the „area contagionis" and the "dotlike thickenings" ornamentation around this region. Many of the workers are of the opinion, that the proximal sides of the specimens of this genus are as spinose as the distal sides. Illustrated figures of *R. protensa* and *R. crocea* of KOSANKE (1950) appear to show that the bacula are from the distal sides.

In addition to the above statements in regard to *Raistrickia* the remarks of POTONIÉ on genus *Neoraistrickia* are also considered. This genus is erected by POTONIÉ from *Trilites truncatus* of COOKSON due to its higher stratigraphic position and absence of coni between the bacula.

Raistrickia alpina n. sp.
(Pl. 1, Figs. 6, 8)

H o l o t y p e : Raistrickia alpina n. sp. Pl. 1, Figs. 6, 8. S. G. P. slide No. 1004, sample No. 1077. Deposited at the Palynological Lab., Geol. Survey of Austria, Vienna.

D i a g n o s i s : Spores are trilete, and are more or less spheroidal in shape. The entire sporecoat is covered with terminally bifurcated bacula except for the area contaginous. This area is ornamented differently as granulose, etc.

Dimensions: 65, (55), 45 microns.

T y p e l o c a l i t y : Austria, Bleiberg (Antonio-Middle shaft, sample No. 1077).

T y p e l e v e l : Upper Triassic, Carnian (Lower Middle Keuper).

D e s c r i p t i o n : Spore is essentially spherical. Trilete mark is inconspicous, but the contact area is distinct and has rounded borders. Exine is thick, and except for the contact area is covered with evenly distributed long, truncate baculiform projections. Bacula are spaced at 3—6 microns approx. The projections are 2—3 microns in length and about 2—3 microns in diameter. The appex of the projections are usually bifurcated. Contact area is without bacula, but covered with scattered, top rounded granular ornamentations. Holotype measures 55 microns in diameter.

R e m a r k s : On the description and in consideration of the discussion given above, this species is classified under the genus *Raistrickia* regardless of its being restricted to the Paleozoic. This new species is rather rare in the Bleiberg samples, it is characterized by its spherical shape, bifurcating bacula, distinct contact area, and granular ornamentations of the area between the rays. To the present author the proximal and the distal sides of the spores, belonging to this genus having evenly distributed baculiform ornamentations, appear to be doubtful. On the other hand this investigation indicates that the proximal sides around the contact area are

without bacula. The new character for this genus is the presence of contact area bearing a different ornamentation than the spore coat outside of the curvature.

The author is also of the opinion that the *Raistrickia* and *Neoraistrickia* are congeneric.

Infraturma *Murornati* Potonié & Kremp, 1954

Genus *Anulispora* de Jersey, 1959

Anulispora punctus (Klaus)

(Pl. 1, Fig. 7)

Distalanulisporites punctus Klaus, 1960, p. 133, pl. 28, fig. 8.

Description: Spore subcircular in equatorial counter. Proximal side is marked by a very pronounced incised trilete mark. Trilete rays do not reach the equator and disappear sharply at $^2/_3$ of the radius. Distal side is characterized by the presence of a thick ring about 5 microns broad and 15—18 microns in diameter. Outer exine is dark yellow and of thickness 4 microns. Surface ornamentation of the exine is punctate. The figured specimen is 36 microns in diameter.

Remarks: This species is closely similar in all respects to the *Distalanulisporites punctus* Klaus, except in that the trilete rays do not reach the equator.

This characteristic Triassic spore is included in the genus *Anulispora* of de Jersey rather than the *Distalanulisporites* Klaus. de Jersey, the first author of *Anulispora*, describes the forms in which the rays do not reach the equator (1962) and also those in which the surface is not smooth (1964).

Genus *Lycopodiacidites* (Couper, 1953) Potonié, 1956

Lycopodiacidites kuepperi Klaus

(Pl. 1, Figs. 3 and 4)

Lycopodiacidites kuepperi Klaus, 1960, p. 135, pl. 31, fig. 27.

Description: The spore is round in equatorial outline. Trilete mark is distinct, extending almost to the equator. Trilete rays are bordered by broad but slightly raised thickenings. Proximal side is essentially smooth and without structure. Distal side is sculptured with irregular ridges about 2—3 microns thick. Exine margin is smooth and about 4 microns thick in optical section. Average diameter of the studied specimen is 44 microns.

Remarks: This species is not very abundant, but generally present in all samples of Bleiberg, and is identical with the species described by Klaus.

Genus *Corrugatisporites* (THOMSON & PFLUG, 1953) ex. WEYLAND & GREIFELD, 1953

Corrugatisporites klausi n. sp.
(Pl. 2, Figs. 1 and 2)

Generotype: *Corrugatisporites toratus*, WEYLAND & GREIFELD, 1953, p. 42, figs. 56—59 (Lectogenerotype fig. 57, POTONIÉ & KREMP, 1955, p. 96; POTONIÉ, 1956, p. 41).

Discussion of the genus: In the description of *Corrugatisporites toratus* and other related forms no specific mention is made about the ornamentation of the distal side. In view of the general appearance of the shape, and surface features already described by early workers, the species described below is tentatively included in this genus. However, the distal fold-like thickening of the present form, is not in accordance with the generotype.

Corrugatisporites klausi n. sp.
(Pl. 2, Figs. 1 and 2)

Holotype: *Corrugatisporites klausi* n. sp. Pl. 2, Figs. 1 and 2. S. G. P. slide No. 1006, sample No. 1077. Deposited at the Palynological Lab., Geol. Survey of Austria, Vienna.

Diagnosis: Round to subtriangular spores, having a developed trilete mark with rays reaching the cingulum, finely pitted surface, somewhat feeble proximal sculptures, and a circular distal fold-like feature.
Dimension: The type specimen is 54 microns in diameter.

Type locality: Austria, Bleiberg, (Antonio-Middle shaft, sample 1077).

Type level: Upper Triassic, Carnian (Lower Middle keuper).

Description: Spore is round to slightly subtriangular in equatorial outline. Trilete mark on the proximal side is distinct, but the rays are not bordered by lips. Trilete rays are long, straight, and almost reach the cingulum. Proximal side is nearly flat and sculptured with two to three parallel rows of discontinuous ridges. These ridges in polar view present a triangular appearance specially towards the center. The cingulum is relatively thin and almost has the same width as the proximal ridges. The distal surface is ornamented by a nearly fold-like thickning feature running closely parallel to the cingulum. Exine is finely pitted.

Remarks: This species is infrequent, but found sporadically distributed in all the samples. It differs from any other species described so far by its well developed trilete mark, finely pitted surface, less pronounced proximal sculptures, and circular distal fold feature.

Genus *Zebrasporites* KLAUS, 1960

Zebrasporites kahleri KLAUS

Zebrasporites kahleri KLAUS, 1960, p. 138, pl. 30, figs. 18—20.

Remarks: This distinct trilete spore is readily identified by its triangular central body, circular equatorial zone, a smooth proximal side, and the radial arrangements of the rugae on the distal side.

Although this species is a rare form among the Bleiberg plant microfossils, its occurrence is of great importance, as it presumably occurs only in shale unit No. 2. Diameter of the figured specimen is 52 microns.

Turma *zonales* (BEENIE & KIDSTONE, 1886) POTONIÉ & KREMP, 1954

Subturma *Zonotriletes* WALTZ, 1935

Infraturma *Zonati* POTONIÉ & KREMP, 1954

Genus *Styxisporites* COOKSON & DETTMANN, 1958

Styxisporites cooksonae KLAUS

(Pl. 2, Figs. 3 and 4)

Styxisporites cooksonae KLAUS, 1960, p. 141, pl. 31, figs. 29, 31.

Description: Spore is roundly triangular to moderately subcircular in equatorial outline. Central body circular, dark brown in colour and thickwalled. Distal side of the central body is irregularily covered with 26—30 conical spines, sometimes up to 5 microns thick. Several unequally distributed pores, specially on the proximal side, are visible in deep focus. Trilete rays distinct, rays bordered by lips and extend almost to the limit of the inner part. Outer flange is bright yellow, thin and smooth. Breadth of the flange varies at places from 9—16 microns. Longest diameter of the figured specimen is 72 microns, and the shortest diameter is 66 microns.

Remarks: This form is undoubtedly similar to *Styxisporites cooksonae* KLAUS. Its occurrence in the Bleiberg samples is sporadical but seems to be somewhat more frequent in shale unit No. 3. It is less frequent in shale unit No. 2, and extremely rare to absent in shale unit No. 1.

If the distinct trilete scar is absent in the present form, it can probably be included in the genus *Kraeuselisporites* LESCHIK belonging to the Subturma *Zonaletes* (as in POTONIÉ, 1958, p. 83). But, as it appears, this form is more identifiable with Styxisporites belonging to the Subturma *Zonotriletes* and hence, is considered in this genus.

The recent view of DETTMANN (1963) in regard to these two genera is also taken into account. It is still believed that the present form differs from *Kraeuselisporites* in having raised lips, different character of the flange, and the very distinct trilete mark.

Turma *Monoletes* IBRAHIM, 1933

Subturma *Zonomonoletes* LUBER, 1935

Genus *Saturnisporites* KLAUS, 1960

Saturnisporites granulatus KLAUS

(Pl. 2, Fig. 5)

Saturnisporites granulatus KLAUS, 1960, p. 143, pl. 32, fig. 34.

Description: Spore is zonomonolete, oval in equatorial outline, and dark brown in colour. Central body is large, surrounded by a thin zone of about 1/8 of the breadth. Monolete scar is flanked on both sides by a thick raised wavy margin, which is not extended beyond the central zone. The wavy feature around the central scar is about 7 microns in width. Exine ornamentation is finely granulose. Length of the figured specimen is 62 microns, and the breadth is 49 microns.

Remarks: This form is quite similar to the species described by KLAUS, but it varies only in being somewhat larger in size.

The author thinks that the genus *Saturnisporites* is quite different from *Aratrisporites* in the following respects. — 1. the outher margin or zone in this genus is very narrow in most cases; 2. the monolete scar does not usually extend beyond the inner zone, and is always flanked on both sides by a raised wavy margin; 3. it also lacks the two polar triangular extensions; and 4. the proximal folds, which are usually present in *Aratrisporites* are not seen in this genus. Furthermore, it is found in a better state of preservation. These differences have been observed in a large number of specimens of both genera and the author holds the opinion of separating them from each other.

It is also necessary to mention, that these two genera are not pollen grains, because the distal side of the central body does not show any significant criterion to assume the existence of any possible air sac around it (BHARADWAJ & SINGH, 1964). Even in case of the occasional presence of folds, these forms can not be assumed to be pollen grains, because such folds may be due to the separation of inner and outer spore walls, as is also observed in *Isoëtaceae* and *Selaginellaceae*.

Genus *Aratrisporites* (LESCHIK, 1955) KLAUS, 1960

Aratrisporites scabratus KLAUS

(Pl. 2, Fig. 6)

Aratrisporites scabratus KLAUS, 1960, p. 147, pl. 32, figs. 37—38; BHARADWAJ & SINGH, 1964, p. 36, pl. 3, figs. 71—75, pl. 4, figs. 76—86.

Description: The spore is zonomonolete, oval to subelliptical in equatorial outline. Central body delimited by a broad zone of about 11 to 6 microns wide on the proximal side. Inward extention of the zone at each pole forms a small triangular area, (anchor), very clearly seen

especially, when the spore is compressed. One or two thin folds may cross the central body, along the shortest axis, on the proximal side. Monolete opening is conspicuous, narrow, and extending the full length of the proximal side. It connects the sharp ends of the two triangular areas situated at the poles. Sculpture pattern is dominantly scabrate. Exine outline is marked with a few but scattered spine-like projections, especially at extremities. The figured specimen measures 59 microns in length, and 52 microns in breadth.

Remarks: This species and all the other previously described species belonging to this genus are present in Bleiberg samples. Unfortunatly the state of preservation is poor and specimens usually contain holes. However, this defect does not prevent the specific identification of the examined specimens. The generic value of these forms is only made use of in the finer stratigraphic division of the Bleiberg area. This genus has its greatest occurrence in the shale unit No. 2, and least occurrence in shale unit No. 1.

Anteturma *Pollenites* POTONIÉ, 1931

Subturma *Circumpolles* (PFLUG, 1953) KLAUS, 1960

Infraturma *Singulipollenites* KLAUS, 1960

Genus *Duplicisporites* (LESCHIK, 1955, POTONIÉ, 1958) KLAUS, 1960

Duplicisporites granulatus LESCHIK

(Pl. 1, Fig. 5)

Duplicisporites granulatus LESCHIK, 1955, p. 23, pl. 2, fig. 23; KLAUS, 1960, p. 161, pl. 35, fig. 33; DE JERSEY, 1964, p. 11.

Remarks: The general shape, the size of the grain, granular sculpture of the exine, and the three distinct folds of the distal side, are in complete agreement with the previous descriptions and figures given for this species. The triletes scar is clearly visible in the recorded specimen. This species may occur in all the samples, but always in a limited number. Size of the figured specimen is 42 microns.

Subanteturma *Eupollenites* KLAUS, 1960

Turma *Saccites* ERDTMAN, 1947

Subturma *Disaccites* COOKSON, 1947

Infraturma *Striatiti* PANT, 1954

Genus *Taeniaesporites* (LESCHIK, 1955) KLAUS, 1963

Taeniaesporites kraeuseli LESCHIK

(Pl. 3, Fig. 1)

Taeniaesporites kraeuseli LESCHIK, 1935, p. 59, pl. 8, figs. 1—6.

Description: This illustrated winged-grain is bilaterally symmetrical and broadly oval in outline. The central body is longer than wide and has four horizontals tripes (taeniea) on the proximal side. The two middle stripes are longer and broader, separated from each other by a wider slit. Other slits are conspicuous but narrow. Air sacs are semicircular, approaching closer on the distal side, slightly yellow, and very-finely reticulate.

Dimension 68 × 44 microns, length of the central body 40 microns.

Remarks: The figured specimen and many other similar forms are the dominant types of disaccate pollen grains in the Bleiberg area. This species (in a restricted sense of LESCHIK) is a good stratigraphical indicator for distinguishing the three different shale units. It interesting to note that when this species is more abundant, the genus *Aratrisporites* is relatively less and vice versa.

Subturma *Monosaccites* (CHITALEY, 1951) POTONIÉ & KREMP, 1954

Infraturma *Aletesaccitus* LESCHIK, 1955

Genus *Enzonalasporites* LESCHIK, 1955

Enzonalasporites tenuis LESCHIK

(Pl. 3, Fig. 4)

Enzonalasporites tenuis LESCHIK, 1955, p. 44, pl. 6, fig. 1; KLAUS, 1960, p. 168, pl. 37, fig. 66.

Description: Shape of the grain is circular in equatorial outline. The central body is circular with diameter of 36 microns, dark brown in colour, and surrounded by a light yellow bladder about 4—5 microns wide. Exine ornamented with small closely packed, and irregularily bent reticulum-like sculptures. Trilete mark is absent. Figure specimen measures 52 microns.

Remarks: This form is identical with the illustrated specimen of KLAUS. It is present in all the samples of Bleiberg but less numerous in shale unit No. 2. The state of preservation is mostly poor and exine ocasionally contains holes due to pyrite impressions.

Turma *Aletes* IBRAHIM, 1933

Subturma *Azonaletes* (LUBER, 1935) POTONIÉ & KREMP, 1954

Infraturma *Granulonapiti* COOKSON, 1947

Araucariacites australis COOKSON

(Pl. 3, Fig. 2)

Granulatisporites (Araucaricites) australis COOKSON, 1947, p. 130—131, pl. 13, figs. 1—4.
Araucariacites australis COOKSON, COUPER, 1953, p. 39; 1958, p. 151, pl. 27, figs. 3—5; BALME, 1964, pl. 6, fig. 17.

Description: Outline oval to subcircular, exine folded with four major folds around the margin. Surface is scabrate to finely granulose, without any germinal opening. Greatest diameter of the figured specimen is 89 microns.

Remarks: Slight variation in size, number of folds, and/or direction of folding among the specimens is present; but they are all inferred to be same as this species. It is the thirdmost abundant form (after *Taeniaesporites* and *Aratriasporites*) in shale units No. 1 and 2.

Turma *Plicates* (Plicata naumova 1937, 1939) POTONIÉ, 1958

Subturma *Praecolpates* POTONIÉ & KREMP, 1954

Genus *Eucommiidites* ERDTMAN, 1948

Generotype: *Tricolpates (Eucommiidites) troedssonii* ERDTMAN, 1948, p. 267, pl. 1, fig. 15.

Grain of medium size, almost prolate, having three colpae usually equal in length with a smooth to structureless exine is recorded by ERDTMAN as the type. The single specimen recorded in this work, in general, appears to have the characteristics of this genus (if it is considered to have a wide variation). The mentioned "ring-furrow" of HUGHES (1961) is not observed in the figured specimen.

Eucommiidites sp.

The sulcus surface is also pitted, but appears somewhat vertically striate in oil immersion. Exine thickness is about 1—1.5 micron in the greater and 2—2.5 microns at the poles. Size of the figured specimen measures 43 microns.

Remarks: This single grain, the only observed specimen from the Bleiberg samples, shows a probable affinity with the genus *Eucommiidites*, but it differs in having a broader median sulcus and much smaller side opening slits. However, the occurrence of this spore in the Triassic sediments is of great significance.

Description: The grain is more or less circular in equatorial outline. It has a long broad sulcus, bordered with two pronounced ridge-like lips, parallel to the sides of the sulcus. Two other short but slightly curved slit-like openings are also present on either side of the sulcus, located near the equatorial margin. Exine is smooth to very finely pitted.

Subturma *Monocolpates* IVERSEN & TROELS-SMITH, 1950

Infraturma *Diptyches* (Naumovea 1937) POTONIÉ, 1958

Genus *Cycadopites* (WODEHOUSE, 1933) ex. WILSON & WEBSTER, 1946

Generotype: Cycadopites follicularis WILSON & WEBSTER, 1946, p. 274, pl. 1, fig. 7.

WILSON & WEBSTER in designation of the type for genus Cycadopites of WODEHOUSE give the following description: "Ellipsoidal; approximately twice as long as wide; length 39—42 microns; with 18—12 microns; furrow extending along total length of grain, open at ends; usually closed in the middle by furrow edges overlapping in shrinkage; surface smooth wall, 1.5 micron thick; translucent"; this description is being used as the generic base for the species described below.

Cycadopites bleibergensis n. sp.

Holotype: *Cycadopites bleibergensis* n. sp. Pl. 3, Fig. 3. S. G. P. slide No. 1012, sample No. 1074. Deposited at the Palynological Lab., Geol. Survey of Austria, Vienna.

Diagnosis: Oval to fusiform grains with narrow median sulcus surrounded by two full length folds on the distal side and a smooth to infrapunctate surface.

Dimension of the type specimen 92 × 37 microns. Size range 110—80 microns in length, and 45—35 microns in breadth.

Type locality: Austria, Bleiberg (Antonio-Middle shaft, sample No. 1074).

Type level: Upper Triassic, Carnian (Lower Middle Keuper).

Description: Outline oval to fusiform with narrow ends. Approximately two and half times longer than wide. Distal furrow reaches full length of the grain, very slightly expanded at both ends. It is surrounded by two folds on slightly raised inner margins of about 1—1.5 micron thick. Exine is smooth to very finely infrapunctate, and about 2 microns thick in optical section. The figured specimen (Holotype) measures 92 × 37 microns.

Remarks: The species recorded here differs from *Cycadopites subgranulosus* (COUPER) (= *Entylissa reticulata* NILSSON) formerly placed under the genus *Monosulcites*, not only by the greater size, but also by the lack of granular ornamentations. It also differs from *Cycadopites potoniei*, BHARDADWAJ & SINGH, in having two distinct distal folds which have not been discussed by them; however, the present species falls in the given size range of the species of the above authors.

DE JERSEY (1962) in his description of *Ginkgocycadophytus adjectus* has discussed the presence of distal folds, which are analogus with those of the present form, but his size range of the species is quite smaller (almost half). This species of Bleiberg is also much smaller in size than *Ginkgocycadophytus deterius* (BALME) n. var. *majus* of SUKH DEV (1961) from India. Thus this form is comparatively different from the other forms described earlier and should be designated as new species. It is a good marker in the Bleiberg area for shale units No. 1 and 2 in which it occurs.

Summary

These are the various observations and results of this investigation:

1. The Upper Triassic Cardita shales of Bleiberg are very rich in various kinds of plant microfossils.

2. The fossil spores and pollen assemblages from the three different shale units of the studied area are closely comparable with studies of LESCHIK (1955) and KLAUS (1960).

3. The genus *Raistrickia* continues in the Upper Triassic and is not exactly restricted to the Paleozoic Period. The proximal side of this genus is generally less ornamented (baculae) than the distal side. In all probability the *Neoraistrickia* is congeneric with this genus.

4. *Saturnisporites* and *Aratrisporites* are two distinct genera with different characters. They are zonomonolete spores, and not pollen grains.

5. The existence of *Eucommiidites* (or *Pre-Eucommiidites* ?) in the Upper Triassic sediments is very probably.

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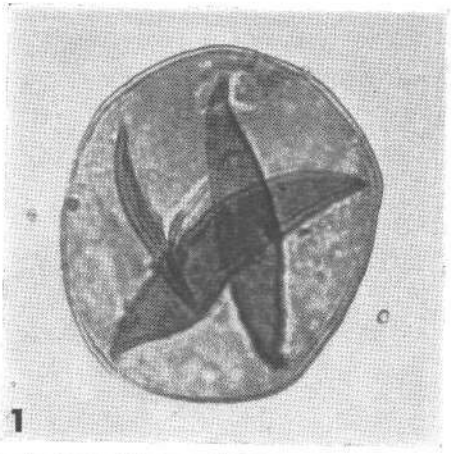
PLATE 1

Magnification 750 ×

Fig. 1. *Aulisporites astigmosus* (Leschik).
Sample No. 1064 (S. G. P. No. 1000).
Fig. 2. *Zebrasporites kahleri* Klaus.
Sample No. 1062 (S. G. P. No. 1001).
Fig. 3. *Lycopodiacidites keupperi* Klaus (Distal).
Sample No. 1066 (S. G. P. No. 1002).
Fig. 4. *Lycopodiacidites keupperi* Klaus (Proximal).
Fig. 5. *Dupliciporites granulatus* Leschik.
Sample No. 1066 (S. G. P. No. 1003).
Fig. 6. *Raistrickia alpina* n. sp. (Proximal).
Sample No. 1077 (S. G. P. No. 1004, Holotype).
Fig. 7. *Annulispora* (Klaus).
Sample No. 1074 (S. G. P. No. 1005).
Fig. 8. *Raistrickia alpina* n. sp. (Distal, Holotype).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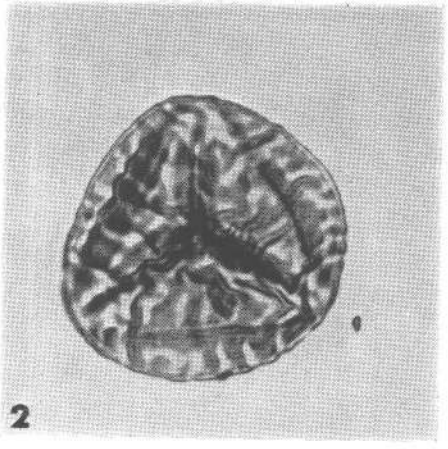
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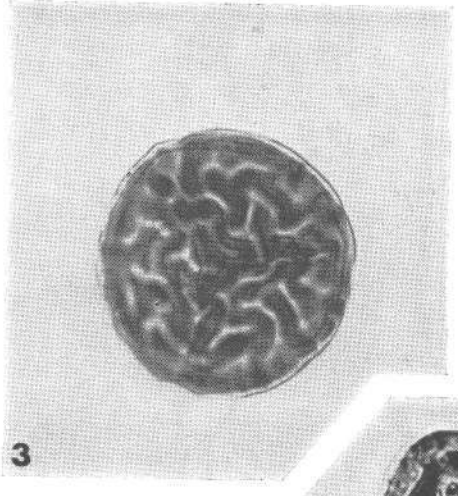
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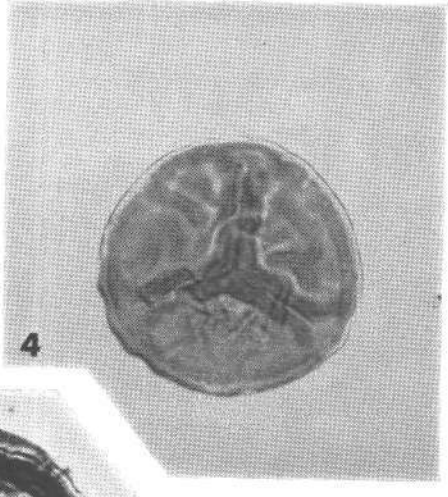
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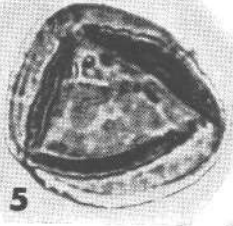
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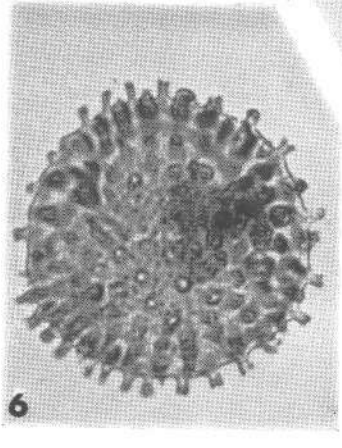
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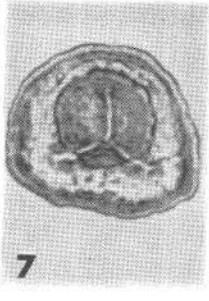
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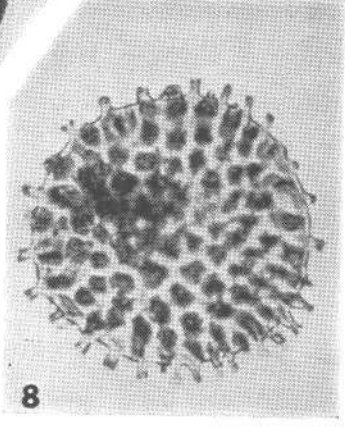
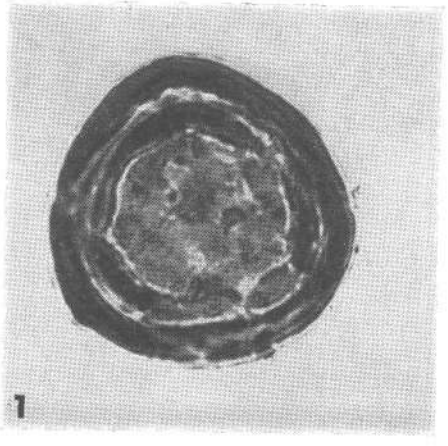
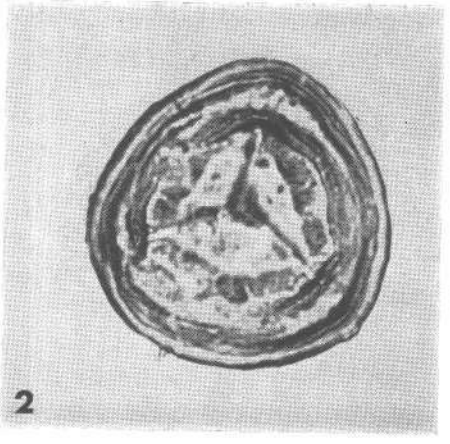

8

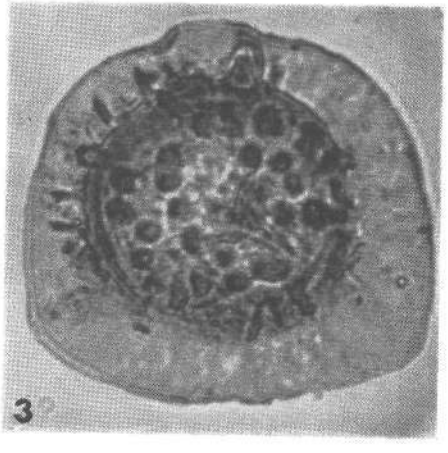
PLATE 2

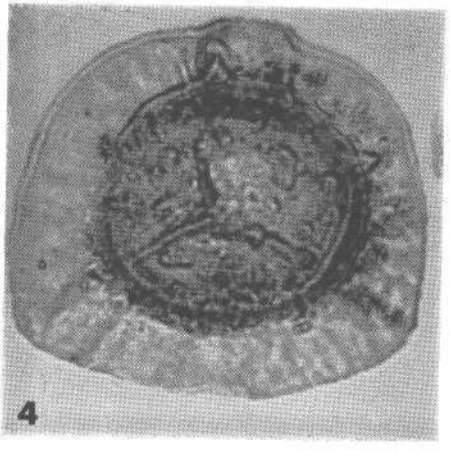
Magnification 750 ×

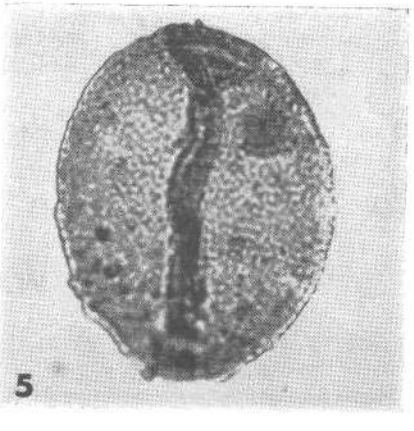
Fig. 1. *Corrugatisporites klausi* n. sp. (Distal).
Sample No. 1077 (S. G. P. No. 1006, Holotype).
Fig. 2. *Corrugatisporites klausi* n. sp. (Proximal, Holotype).
Fig. 3. *Styxisporites Cooksonae* KLAUS (Distal).
Sample No. 1062 (S. G. P. No. 1007).
Fig. 4. *Styxisporites Cooksonae* KLAUS (Proximal, same specimen).
Fig. 5. *Saturnisporites granulatus* KLAUS.
Sample No. 1077 (S. G. P. No. 1008).
Fig. 6. *Aratrisporites scabratus* KLAUS.
Sample No. 1062 (S. G. P. No. 1009).











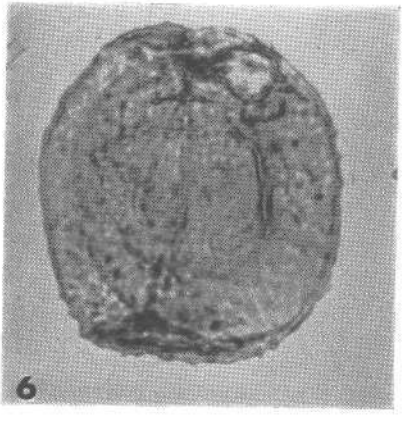


PLATE 3

Magnification 750 ×

Fig. 1. *Taeniaesporites kraeuseli* LESCHIK.
Sample No. 1074 (S. G. P. No. 1010).
Fig. 2. *Araucariacites australis* COOKSON.
Sample No. 1073 (S. G. P. No. 1011).
Fig. 3. *Cycadopites* n. sp.
Sample No. 1074 (S. G. P. No. 1012, Holotype).
Fig. 4. *Enzonalasporites tenuis* LESCHIK.
Sample No. 1073 (S. G. P. No. 1013).
Fig. 5. cf. *Cycadopites.*
Sample No. 1066 (S. G. P. No. 1014, Holotype).
Fig. 6. cf. *Cycadopites.*
Sample No. 1066 (S. G. P. No. 1015, Holotype).
Fig. 7. *Eucommiidites* sp.
Sample No. 1066 (S. G. P. No. 1016).